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b. If the dog always keeps on the line joining his starting point to the duck's position, the solution becomes quite simple.

Then $us=2a\psi$ is the intrinsic equation to the dog's path.

$$\therefore \frac{ds}{d\psi}=\frac{2a}{u}=\sqrt{r^2+\left(\frac{dr}{d\psi}\right)^2}. \therefore d\psi=\frac{dr}{\sqrt{\frac{4a^2}{u^2}-r^2}}, \text{ and } \psi=\sin^{-1}\frac{ur}{2a}.$$

When $r=2a\cos\psi$ the dog catches the duck.

$\therefore \psi=\sin^{-1}(u\cos\psi)$, or $\tan\psi=u$, and $\psi=\tan^{-1}u$.

$\therefore us=2a\tan^{-1}u$, or $s=(2a/u)\tan^{-1}u=(2an/m)\tan^{-1}(m/n)$ is the distance the dog swims to overtake the duck.

MECHANICS.

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225. **Proposed by W. A. BALDWIN, Springfield, Mo.**

Find, *by means of polar coordinates,* the moment of inertia about the origin of the area between the parabola $ay=2(a^2-x^2)$, the circle $x^2+y^2=a^2$, and the axis of Y.

Solution by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.

The polar equation to the parabola is

$$r=\frac{a[\sqrt{(1+15\cos^2\theta)}-\sin\theta]}{4\cos^2\theta}=r_1.$$

The polar equation to the circle is $r=a$.

$\therefore m$, moment of inertia required,

$$=\int_{\pi/6}^{\pi/2}\int_{a}^{r_1} r^3 d\theta\, dr=\frac{a^4}{1024}\int_{\pi/6}^{\pi/2}[8\sec^8\theta+112\sec^6\theta+136\sec^4\theta-256$$

$$-8\sin\theta\sec^6\theta(7+\sec^2\theta)\sqrt{(1+15\cos^2\theta}]d\theta=\frac{a^4}{4}\left(\frac{883\sqrt{3}}{280}-\frac{\pi}{3}\right).$$

This is problem 7, p. 350, Osborne's *Differential and Integral Calculus.* Osborne gives as the result, $(\frac{52}{35}-\frac{1}{8}\pi)a^4$. Professor Zerr's result is correct. ED. F.